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Membership on 15th August, 1951

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Menzies, O. C. G., 86 Coventry Street, Galloways Hill, Brisbane.
Possingham, J. V. Trevor, Main Road, Blackwood.
Read, I. W., 153 Picnic Point, Sydney, N.S.W.
Robotham, A., Church Street, Castle Hill, N.S.W.

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Lohwag, Dr. Kurt, Gregor Mendel-Strasse 33, Wien XVIII.

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Vermeulen, L., Diegemstraat 10, St. Stevens Woluwé, Zaventem.
Walravens, W. R., Drie Egypten, Gooik (Br.).
Willam, Dr. A., Institut De Botanique, Rue Fusch, Liège.

BERKSHIRE

Belcher, W. S., Pine Drive, Wokingham.
Edwards, J. & A. H., Speen Cottage Hotel, Bath Road, Newbury.
Etheridge, J. H., 32 The Field, Dry Sandford, Abingdon.
Hunt, C. H., Sutton's Advisory Service, Royal Seed Establishment, Reading.
Jenkins, T. K., 64 Connisborough Avenue, Caversham, Reading.
Longwood & Culham Nurseries Ltd., Culham, Abingdon.
Miller, Miss S. A., The Barn, Littlewick Green, nr. Maidenhead.
Wells, G. A., 48 Ashburton Road, Reading.

BUCKINGHAMSHIRE

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Fryer, R. S., Nashleigh House, Chesham.
Johnson, Capt. M. M., Hundridge House, Gt. Missenden.
Percy, E. J. V., Park Cottage, Hartwell, Aylesbury.
Stewart-Wood, J., Aylesbury Mushrooms Ltd., Ford, nr. Aylesbury.

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Barton, K. P., 8 O.M.Q., Ely Road, Waterbeach.
Dillon Weston, Dr. W. A. R., Anstey Hall, Trumpington.
Hutchons, J. H., Lynwood, Parsons Drove, Wisbech.
Pizer, Dr. N. H., Anstey Hall, Trumpington.
Sleight, W., Goat Lane, Gorefield, nr. Wisbech.
Taylor, Dr. R. E., 10 Christs Lane, Cambridge.

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Baylay, W. F., Campbell Soup Co. Ltd., New Ontario, Ontario.

CHANNEL ISLANDS

Dunn, J. C., 3 Green Street, St. Helier, Jersey.

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Gamble, Capt. R. A. N., Lea Hall, Lea by Backford, nr. Chester.
Wild, R. F., 10 St. Vincent Road, Cloughton, Birkenhead.

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Wadsworth, R. C., 14 Broadwath, Headsnook, Carlisle.

Co. DURHAM

Hunter-Carr, J., 40 Sunderland Road, South Shields.
Thompson, J. R., Market Gardener, Stapleton, Darlington.

DENMARK

Christensen, W., Højvangsvej, Glostrup.
Hansen, Preben, Mia Mara, Kirkebjerg Alle, Glostrup.
Jørgensen, P., Osterlund, Ejbyvej, Skovlunde.
Klougart, A., Anker Heegaardsgade 2, Copenhagen V.
Nielsen, Erik, Gladsaxelroj, Branddamsvej, Søberg.
Nielsen, Niels, Gladsaxelroj, Branddamsvej, Søberg.
Paludan, Professor H., Helsebakken 15, Hellerup.
Rasmussen, C., Skovvej 11, Jaarbek, pr. Klampenborg.
Svendsen, K., Fuglsang, Farum.

DERBYSHIRE

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Johnson Bros. & Co. (Derby) Ltd., Wholesale Market, Derby.
Smith's Runners Ltd., Holme Bank Mine, Bakewell.
Steer, W. L., N.A.A.S., Chardlow Hall, Derby.
Wingfield, M., 35 Osecroft Estate, Shuttlewood, nr. Chesterfield.

DEVON

Abbiss, H., Provincial Horticultural Officer, Staplake Mount, Starcross, Exeter.
Carruthers-Stewart, S., Hillfield, Stoke Gabriel, Totnes.
Currie, W. D., Rylthorpe, Chudleigh, nr. Newton Abbot.
Jones, L. F., Lower Meddon Street, Bideford.
Randall, C. J., The Nursery, Rockbeare, Exeter.
University College, The Librarian, Roborough Library, Prince of Wales Road, Exeter.

DORSET

Bulloch, McGregor, c/o Blandford Farm Products, Blandford.
Douglas, Brigadier A.S.G., Stourpaine House, Blandford.
Maloney, C. E., Gillingham.

EIRE

Allan, R. Ivan, Imokilly Orchards, Shanagarry, Co. Cork.
Boland, Miss E. M., Glenards, Galway.
Donnelly, J., Iona Fruit Farm, Oldtown, Co. Dublin.
Flanagan, J. B., 20 Achill Road, Drumcondra, Dublin.
Fletcher, R. H., Kildare Products, Rathangan, Co. Kildare.
Groom, R., Irish Nurseries, Kimmage Road West, Dublin.
Killian, R. T., Beverston, Mount Annville Road, Dundrum, Co. Dublin.
Meath Packers Ltd., Dunshaughlin, Co. Meath.

ESSEX

Bennett, A. D., 64 Ashley Road, Dovercourt.
Duthy, R., Greenacre Graded Mushrooms, Little Horkesley.
Gibbons, J. S., Takeley Nurseries Ltd., Takeley.
Hall, E. J., Layer Mills Ltd., Layer-de-la-Haye, Colchester.
Hopping, C. H., Pick Hill, Waltham Abbey.
Icklow, S., Carabis Nurseries, Pick Hill, Waltham Abbey.
Jones, F., 312 Eastwood Road, Rayleigh.
Kaufman, M., 20 Cliff Road, Leigh on Sea.
Kilian, H., Baddow Park, Gt. Baddow, nr. Chelmsford.
Lovering, J. W., Abbey View Nursery Ltd., Galley Hill, Waltham Abbey.
Moorhouse, J. H., Jupes Hill, Dedham, Colchester.
Pan Britannica Industries Ltd., Waltham Abbey.
Parsons, Mrs. R. L., Great Braxted Hall, Witham.
Pinkerton, R. H. & Sons, Lubards Lodge, Hullbridge Road, Rayleigh.
Russell, Mrs. J., Mount Hall, Gt. Horkesley.
Shewell-Cooper, Lt. Col. W. E., Horticultural Bureau, Thaxted.
Simons, J. E. R., Natts Farm, Harlow.
Simons, Roy, Natts Farm, Potters Street, Harlow.
Smith, W. D., Grange Nurseries, Woodham Road, Battlesbridge.
Speller, R. L., Hoe Lane, Nazeing.
Stevens, W., Thornwood Common, Epping.
Ward, G. C. P., Lime House Nursery, Rayleigh.
White, E. T. W., Wendy, Berechurch Hall Road, Colchester.

FINLAND

Rautavaara, Dr. T., Maneesik I B, 14, Helsinki.

FRANCE

Blancs Français de Semis le Champion, 37 Rue de Dijon, Bordeaux.
Chapuis, G., Arbois, (Jura).
Chaumette, R., 19 Route du Grand Pont, Le Vesinet (S. et O.).
Dekeirel, P., 7 bis, Rue du Louvre, Paris.
DesNoues, Yves, La Tour de Salvagny, Rhône.
Dezarnaulds, B., Bourre, Montrichard (Loir et Cher).
Guiochon, P., Champignoniste, Mesnil-le-Roy, (S. et O.).
Jeanson, M., Domaine Du Marquenterre, Par Rue, (Somme).

FRANCE—contd.

Lombrage, G., Domaine D'Estoublon, Fontvieille.
Lombrage, P., 12 Brd. Roy Rene, Aix en Provence.
Nail, Abel, Chancay, (Indre et Loire).
Renard, G., Rue de la Grue, Carrières-S/Seine, (S. et O.).
Sarazin, André, 324 Route de St. Germain, Carrières-S/Seine,
(S. et O.).

GLOUCESTERSHIRE

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Bristol.
Bramwell, R. Lincoln, 6 Bourneside Road, Cheltenham.
Coachwork Specialists Ltd., 292 Two Mile Hill, Kingswood, Bristol.
Furley, E., Walton Cardiff Manor, Tewkesbury.
Meade, R., Lower Farm, Compton Abdale, Cheltenham.
Newland Products Ltd., The Tunnels, Newland, Coleford.
Richards, G. E. A., The Nurseries, Willsbridge, nr. Bristol.
Wakelyn-King, J. C., 238 Old Bath Road, Cheltenham.

HAMPSHIRE

Batten, E. J., Brookside, Brookside Road, Bedhampton.
Bell, Lt. Col. H. G., Newnham Hill, nr. Basingstoke.
Clarke, M. S., Crowd Hill Mushroom Farm, Fair Oak, nr. Eastleigh.
Hampshire Guano Co. Ltd., Soberton, Southampton.
Hassell, E. T., Branksome House, Waltham Chase, Southampton.
Lawrence, Capt. G. P., Barrow Hill, Goodworth Clatford, nr.
Andover.
Lendon Ltd., Lendon House, Brudenell Avenue, Canford Cliffs,
Bournemouth.
Manners, K., 20 Bull Farm, Kingsworthy.
Rooke, Dr. A. R., Beechcroft Nursery, Four Marks.
Trusler, W. J., 89 Kite Hill, Kempshott, Basingstoke.
Warwick, R. G., Wickham.
Wells, J. A., 66 Peabody Road, South Farnborough.
White, Dr. H. L., 4 Ipswich Road, Bournemouth West.
Wills, A. R. Ltd., Tadburn Nurseries, Romsey.

HEREFORDSHIRE

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Godfrey, P. F., Wanatchee Products, Much Birch, Hereford.

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Allen, R. L., Rockwood Nurseries, Shepreth, nr. Royston.
Atlas Basket Co. Ltd., Atlas Works, Harpenden.
Biss, S. G., 22 Eleanor Cross Road, Waltham Cross.
Combe, T. W. B., Scatterdells, Chipperfield.
Fowler, J. E., The Farm, Broxbourne.
Gibson, Mrs. W., Wyddiall Hall.

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How, W. L., 22 Penn Road, Park Street, St. Albans.
King, Geo. W. Ltd., Hartford Works, Hitchin.
Monro, Geo. Ltd., Technical Department, Waltham Cross.
Murphy Chemical Co. Ltd., Wheathampstead.
Orchard, O. B., Orwinton, New Road, Broxbourne.
Skillman, E., The Research Station, Cheshunt.
Standard Range & Foundry Co. Ltd., Queens Road, Watford.
Williams, H. N., Old Rectory, Throcking, nr. Buntingford.

HOLLAND

Bels, Dr. P. J., Provinciale Weg 276, Houthem St. Gerlach (L).
Woltman, J. P. H., Kalwykscheweg 22, Wassenaar.

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Luxmoore, M.C., Sunnymead, Glatton.

ISLE OF MAN

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ISRAEL

Etzioni, E., Neve-Ilan Settlement, Doar Harejehuda.
Kohn, S., Matsouba Settlement, Nahariya, P.O.B. 6.
Kovacs, Julius, P.O.B. 587, Tel-Aviv.
Sellinger, E., Kfar Asar, nr. Tel-Aviv.

ITALY

Rocke, Lt. Col. C. E. A. S., Villa da Schio, Costozza di Vicenza.

KENT

Allen, G. V., Bilting Cottage, Bilting, Ashford.
Allnutt, Frere, Palmsted Hill, nr. Canterbury.
Ball, H. N., Coombebank Market Garden, Sundridge, Sevenoaks.
Bugge's Insecticides Ltd., London Road, Sittingbourne.
Collier, Sir Conrad, Fairbourne Manor, Harrietsham.
Dorey, O. G., Wye College, Ashford.
Glasscock, H. H., N.A.A.S. Sub-Centre, Olantigh Road, Wye, Ashford.
Gook, E. A., Hegdale Cottage, Boundgate, Badlesmere, nr. Faversham.
Hall, A., Riverside, Lyminge.
Harding, N. D., Temperance Hotel, 52 High Street, Tenterden.
Harding, W. A. B., Stone Lodge Farm, Tenterden.
Harrison, A. D., N.A.A.S. Sub-Centre, Wye, Ashford.
Jackson, R. L. O., Park Cottage, Doddington, Sittingbourne.
Leach, T. T., Walford House, Smarden.

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Martin, A. W., Poison Cross Nurseries, Eastry.
Moreton, B. D., N.A.A.S. Sub-Centre, Wye, Ashford.
Mount, E. H., Pembroke Lodge, Dover Road, Walmer.
Mount, H., Woolton Farm, Bekesbourne, Canterbury.
Oldfield, J. R., Doddington Place, nr. Sittingbourne.
Pritchard, P. A., 8 Admiralty Terrace, Upnor, Rochester.
Simkins, Major A., Littlepagehurst Farm, Staplehurst.
Smith, G. C., Loddington Farm Ltd., Linton, Maidstone.
Stedall, G. St. G., Cherry Garden Lane, Folkestone.
Turner, Col. W. A., Poult House Gardens, Tonbridge.
Ware, Dr. W. M., Brookfield, Wye, Ashford.
Weskett, H., Fairbourne Manor Cottage, Harriestsham.

LANCASHIRE

Ashton, J. R., Southport New Road, Tarleton, nr. Preston.
Beardsell, D. R., 6 Cable Street, Formby, Liverpool.
Bell, F., Mere Lane, Tarleton, nr. Preston.
Bleazard, F., Cornwall Place, Blackpool.
Bradley, K. C., Lodge Lane Nurseries, Lytham.
British Basket & Besto Co. Ltd., Irlam, Manchester.
Collins, Gordon, 23 Queen Street, Liverpool, 1.
Davey, T. W. Ltd., Smithfield Market, Manchester 4.
Fitzpatrick, P. & T. Ltd., 22 Queen Square, Liverpool 1.
Fraser, R. J., 3 Owen Street, Accrington.
Garner, W. R., Ridgmont Poultry Farm, Moss Lane, Hesketh Bank, nr. Preston.
Gleave, D. B., 264 Church Road, Haydock, St. Helens.
Kay, Wm. C., Old Brook Hall Farm, Bold, nr. Widnes.
Martland, R. G., Burscough Bridge, Ormskirk.
Mrs. Mulligan's Mushrooms Ltd., 1 Harcourt Road, Blackpool.
Olverson, N., Kershaws Farm, Smithy Lane, Scarisbrick, nr. Ormskirk.
Orritt, T., 48 Orrell Lane, Burscough Bridge, Ormskirk.
Thwaites, J. (Liverpool), Ltd., 12 Gt. Charlotte Street, Queen Square, Liverpool.
Thwaites, J. (Manchester), Ltd., Smithfield Market, Manchester.
Tinniswood, R. N., 48 Market Street, Westhoughton.
Vitax Fertilizers Ltd., Burscough Bridge, Ormskirk.
White, R. W., Colwyn, Scotforth Road, Lancaster.

LEICESTERSHIRE

Grant, M. J. & K., Marigold Nurseries, Gt. Bowden, Market
Harborough.

LINCOLNSHIRE

Atkins, J. H. C., Nuttree Cottage, Ufford, Stamford.
Brook, D., South Drove House, Spalding Common, Spalding.
Cutting, J. & Son, Water Street, Stamford.
Grant, F., 30 Low Fulney Estate, Spalding.

LINCOLNSHIRE—*contd.*

Maltby, Mrs. J., Birdcroft, Anderby, Chapel St. Leonards, Skegness.

Marshall, S. E., The Mill, Butterwick, Boston.

Wright, C. W., Otter's Lodge, Tallington, Stamford.

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Barnes, P. R., London Co-op. Ltd., 54 Maryland Street, Stratford, E. 16.

Broome & Green Ltd., Covent Garden Market, W.C.2.

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Gardner, R. W., 20 Hazlake Road, East Acton, W.3.

Gibbens, Mrs. A. M., 58 Lancaster Avenue, West Norwood, S.E.27.

Hudson, C. E., 1-4 Cambridge Terrace, Regent's Park.

Knight, L., Brooklyn, Sewardstone, Chingford, E.4.

Lazlo, P. D. de, 26 Hill Street, London, W.1.

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Piette, Dr. D. L., 108 Teignmouth Road, N.W.2.

Poupart, T. J. Ltd., 110 Long Acre, W.C.2.

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Rozanski, K., 8 Coleherne Road, S.W.10.

Thwaites, J. (London) Ltd., 31 James Street, W.C.2.

White Queen Ltd., 11 West Bourne Street, W.2.

Wilson, Major D. A., 76 Holland Park, W.11.

Wood, G. B., Putney & Coombe Mushroom Farm, 392 Upper Richmond Road, Putney, S.W.15.

MALAYA

Souza, Miss A. de, Methodist Mission, Coleman Street, Singapore.

MIDDLESEX

Berry, O. G., The Dell Mushroom Farm, Reservoir Road, Ruislip Common.

Holland, J., 44 St. John's Road, Isleworth.

Stevens, P. J., Poplar Farm, Chertsey Road, Feltham.

NEW ZEALAND

Bangert, V. E. R., 1 Waipapa Road, Hāitaitai, Wellington.

NORFOLK

Bedingfeld, Lady P., Oxburgh Hall, King's Lynn.
Dyke, R. A., Estate Office, Raynham, Fakenham.
Gough, F. & Son, 63/69 Fishergate, Norwich.
Read, F. G., South Cottage, Deopham, Wymondham.
Reckowicz, R., Little Ormesby, Ormesby, Yarmouth.
Townshend, The Marchioness, of Raynham, Raynham Hall, Fakenham.
Whitaker, Major C.P., Holmbush, Thornham, King's Lynn.
Woodsend, Dr. R. G., Valley Farm, Brancaster Staithe, King's Lynn.

NORTHAMPTONSHIRE

Atkins, Fred. C., c/o Noble Mushrooms Ltd., Yaxley Sidings, Peterborough.
Atkins, P. C., 368 Fulbridge Road, Peterborough.
Brown, G., Mushroom Research Station, Yaxley, Peterborough.
Brown, H. A., Avalon, Peterborough Road, Farcet, Peterborough.
Edwards, Dr. R. L., Director of Research, Mushroom Research Station, Yaxley, Peterborough.
Flegg, P. B., Mushroom Research Station, Yaxley, Peterborough.
Gandy, Miss D. G., Mushroom Research Station, Yaxley, Peterborough.
Gibbens, R. H. T., 25 West Glebe Road, Corby.
Lee, C. C., Pilton Manor, Oundle, Peterborough.
Lilley, B., 8 Alexander Terrace, Finedon, Wellingborough.
Millinger, R. D. van, The Stone House, Ravensthorpe.
Noble, B. A., c/o Noble Mushrooms Ltd., Yaxley Sidings, Peterborough.

NORTHERN IRELAND

Bates, Geo. & Son Ltd., St. George's Market, Belfast.
Haycock, Major W. L., Bann Mushroom Co., Castle Street, Portadown.
Johnston, A. E., Chief Horticultural Officer, Ministry of Agriculture, Stormont, Belfast.
McGredy, S., Royal Nurseries, Portadown.
Nelson, R. G., Ballylumin, Ahoghill, Co. Antrim.
Nichol, J., 12/14 Clonavon Terrace, Ballymena, Co. Antrim.
Patterson, R., Monlough Food Production Co. Ltd., Ballygowan, Belfast.
Young, M. B., Mountsandel, Coleraine, Co. Londonderry.

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Pearson, S. & Son, 40 Green Market, Newcastle-on-Tyne, 1.
Rhodes, J., Elswick Hall, Elswick Park, Newcastle-on-Tyne.

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Opslandske Konservesfabrikk, Brummunddal.

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Cave, A. E., The Hollies, East Bridgeford.

Cwynar, S., 392 Valley Road, Basford.

Lichtarowicz, L., 7 Mapperley Park Drive, Nottingham.

Makowski, W., Old Estate House, Wollaton, Nottingham.

Smalley, Geo. Ltd., Sneinton Market, Nottingham.

Tooley, C. W. & Sons Ltd., Wholesale Market, Nottingham.

OXFORDSHIRE

Mann, C., Haileywood Estate, Shiplake.

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Alexander, Mrs. E. K., Red House Mushrooms, Bridge of Allan, Stirlingshire.

Allan, F., Cedars, Forgandenny, Perthshire.

Allsop, H. S., Kingsley, Fennwick Road, Kilmaurs.

Beveridge, J., Bridgend, Kinross.

Calder, J., Lochside Dunnet, By Thurso, Caithness.

Dingwall, I.G.P., College of Agriculture, 5 Rose Terrace, Perth.

Dumbreck, R. D., Mossgiel, Dysart, Fife.

Galbraith, W. S., Albethy, Bridge of Allan, Stirlingshire.

Gilchrist, R., Privick Nursery, Ayr.

Grampian Engineering Co., Causewayhead, Stirling.

Hayward, W. T., 86 Cummings Drive, Mount Florida, Glasgow, S.2.

Helebrandt, K. S., Kingsley, Crieff, Perthshire.

Jackson, T., Dillaburn, Lesmahagow, Lanark.

Kennedy, A. D., Meadowbank, Private Road, Gorbridge, Midlothian.

McArthur, G. M., Dens Road, Abroath.

Melville, A. Campbell, Fala, Errol, Perthshire.

Nuthall, Miss C., 8 West Smeaton Street, Kirkcaldy, Fife.

O'Connor, General Sir Richard, Kincurdie, Rosemarkie, Ross-shire.

Oliver, A. P., The Mushroom Sheds, Buckholme Mill, Galashiels.

Pinkerton, M. H., Hogganfield Farm, Millerston, Glasgow.

Pinkerton's Scottish Mushroom Laboratories, Millerston, Glasgow.

Robertson, C., Mushroom Grower, Glenturret, Crieff, Perthshire.

Stratton, T., 1 Nethermill Cottages, Aberargie, Abernethy, Perthshire.

Walker, Alex., 5 Irvine Road, Kilmaurs, Ayrshire.

Youngman, H., Moorfield, Drumchapel, Glasgow.

SHROPSHIRE

Austin, W. H., Burleydam, Whitchurch.

Leese, Lt. General Sir Oliver, Lower Hall, Worfield, Bridgnorth.

Walker, H., Pell Wall Racing Stable, Market Drayton.

SOMERSET

Griffiths, G., Wrington Vale Nurseries, Congresbury.
Pointing, S., Byfield Farm, Combe Down, Bath.
Thirsk, G. E., Wellisford Manor, nr. Wellington.

SOUTH AFRICA

African Mushroom Industries, P.O. Hillcrest, Natal.
Denny, W. L. M., Everglades Mushroom Farm, P.O. Lynhurst,
Johannesburg.
Few, Major M.E., P.O. Box 640, Salisbury, S. Rhodesia.
Hedley, Dr. E. P., Ottos Bluff, Natal.
Heywood, H. W., Main Road, P.O. Kloof, nr. Durban.
Robertson, Mrs. H. F. G., P.O. Box 93, Bergvlei, Nr. Johannesburg.
Scott, R. G., 10 Cartledge Avenue, Rossburgh, Natal.

STAFFORDSHIRE

Bates, J. St. G., Heathfield House, Heath Town, Wolverhampton.
Brown, P. C., The Birches, The Coppice, Biddulph, Stoke-on-Trent.
Burr, J. B., Kingfisher Mushroom Co. Ltd., Heath Brook, Wall
Heath.
Cattermole, F. L., 28 Stafford Street, Longton, Stoke-on-Trent.
Dickinson, T., Wholesale Market, Wolverhampton.
Howse, R. R., Nine Acre Farm, Codsall.

SUFFOLK

Bacon, R., The Priory, Borley, Sudbury.
Carlton, P., Church Lane, Mill House, Little Stonham, Stowmarket.
Freeman, Lt. Col. J. E. B., Buxhall Vale, Stowmarket.
Griffiths, D., Amento, Moulton, Newmarket.
Vansittart, K. B., Drinkstone House, Drinkstone.

SURREY

Ady, J. E., Silverbrows, Rowly Drive, Cranleigh.
Baker, G. W., Broadham Produce Co. Ltd., Station Road, Oxted.
Batchelor, J. G., Borrow House, Churt.
Burrows, S., 105 Oaks Avenue, Worcester Park.
Bushell, D. C. & Co. Ltd., Sandhurst Mills, Camberley.
Dalton, D. N., Leigh Mill House, Godstone.
Frost, F. P. & Co. Ltd., Ridgeway Road, Dorking.
Heather Farm Ltd., Horsell Common, Woking, Chobham.
Keens, W. F., 29 Meadway Drive, Horsell, Woking.
Lane, H. & Son Ltd., 404/6 Sydenham Road, Croydon.
Lougher, D. Unett, Keston Cottage, Puttenham, nr. Guildford.
Millais, E. G., Crosswater Farm, Churt.
Milton, S. J., 32 Border Road, Haslemere.
Nomnensen, D. M., Crosswater Farm, Churt.
Redwing Forest Products Ltd., Reliant Works, Brockham, Betch-
worth.
Rice, G., "Thirlmere," Littlehampton Road, Goring-by-Sea.

SURREY—*contd.*

Riddlesdown Mushroom Farm, Ridding Cottage, Harestone Hill, Caterham.
Sparling, T. A. G., Bridges Wood, Burstow, nr. Horley.
Stockwell, J. A., St. Ives, Rydens Avenue, Walton-on-Thames.

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OCTOBER 1951

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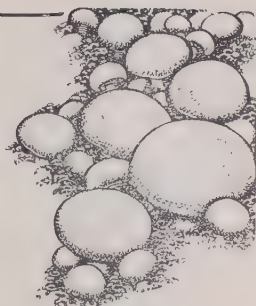
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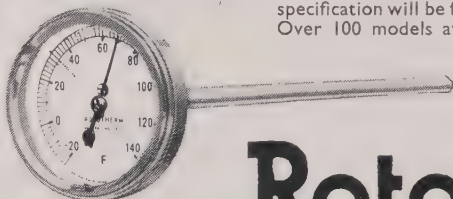
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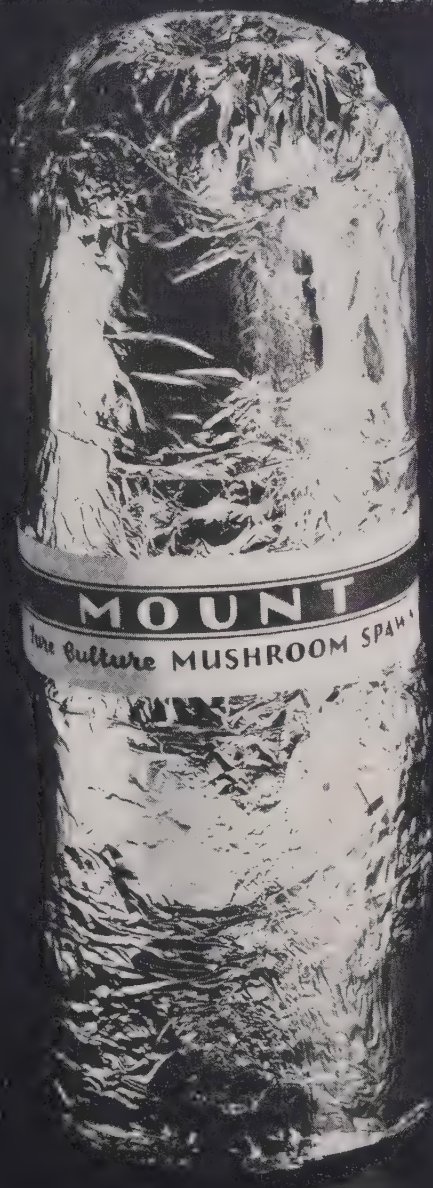
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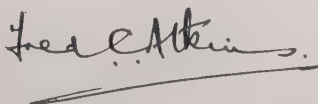
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EDITORIAL

How to Kill an Association

1. Don't attend the meetings.
2. If you do attend—come late.
3. If the weather doesn't suit you, don't dream of attending.
4. If you do attend, find fault with the officers and other members. Sit at the back and talk to the man next to you about the weather.
5. Never accept office—it's much easier to criticise than to do things.
6. Get sore if you are not appointed to a Committee, but if you are appointed, then don't attend any meetings.
7. If asked by the chairman for your opinion, just tell him you have nothing to say, and then after the meeting tell everyone how things ought to be done.
8. Do nothing more than is absolutely necessary, but when other members roll up their sleeves and do it all, howl about the association being run by a clique.
9. Hold back your subscription as long as you possibly can, so as to give the Secretary some unnecessary work.
10. Start a whispering campaign about the Association's finances.
11. Don't bother about getting new members—let someone else do it.
12. Never contribute to your industry's journal. This bucks up the Editor no end, and enables him to make constant improvements.

—with acknowledgements to BILL SANDFORD (*Fruit Trades' Journal*, 6.5.50).

A handwritten signature in dark ink, reading "Fred C. Atkins." The signature is written in a cursive style with a long horizontal line underneath.

VENTILATION AND THE

The need for adequate air movement has always been appreciated by the cave growers on the Continent, but it is felt that many growers do not fully realise the importance of ventilation in houses devoted to mushroom production.

The mushroom is an aerobic organism which needs air in the bed for the growth of the spawn, and over the bed for the formation and growth of the fruit bodies. It produces carbon dioxide and probably other volatile waste products which must be dispersed or they will prevent further growth. Considerable amounts of water vapour are given off and some evaporation may be necessary at the surface of the bed to help fruiting; and in order that water may be given off the air must not be permanently saturated. This is unlikely under the conditions in our mushroom houses at most times but might happen in caves with little or no ventilation.

Lambert (1933) was the first to show that excessive amounts of carbon dioxide were able to affect the shape and size of the mushroom. Later Mader (1943) suggested that volatile organic substances given off from the beds during cropping were able to affect the fruiting capacity of the mushroom spawn. Lambert

(1939) suggested that two changes of air per day would be sufficient to allow for the proper production of mushrooms in houses.

EFFECTS ATTRIBUTED TO POOR VENTILATION CONDITIONS

1. Death of the spawn, due to a rise in the bed temperature either before or after casing, is a condition met with from time to time. Increasing the amount of air passing through the house should be sufficient to maintain the beds at an even temperature.

2. Stroma. The development of this condition in which the beds become covered with a dense mat of spawn and fail to produce a flush of mushrooms is attributed to lack of air movement or excessively high humidity. Very commonly the first flush is affected in this way when the ventilation has been reduced for too long a time

3. Inhibition of mushroom production is met with under stagnant air conditions in caves. A typical instance is described by Bels-Koning (1950) where ridge beds in a cave gave an excellent spawn run but failed to fruit until ventilation was improved.

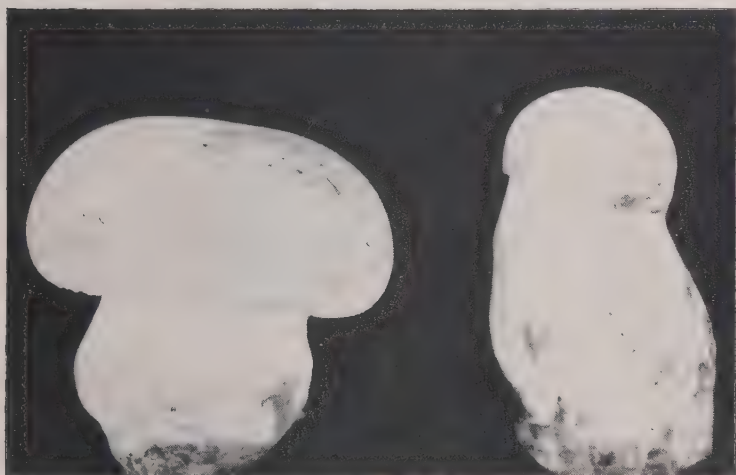
4. An increase in the number of pinheads formed has been recorded by Mader (1943) as being associated with poor air conditions. Similar effects were observed by Middlebrook & Storey

GROWTH OF MUSHROOMS

by Dr. I. F. Storey & Dr. R. L. Edwards

(1950) during the summer of 1949 in Handcraft houses at Brayton. Large patches of pinheads were produced in the middle of the beds and these failed to mature.

The onion-like mushroom (a) with a small cap and swollen stalk is similar to that described by Mader. The other mushroom illustrated (b) shows a more



(b)

Fig. 1

(a)

5. **Abnormally large and misshapen mushrooms** were also produced under the same conditions as those in the last category, and were described by Mader. These have been seen from time to time in this country and two very common types of abnormality are shown in Fig. 1.

normal type of cap but the stalk is swollen and rather bulbous at the base.

6. **Long stalked mushrooms.** Lambert (1933) found experimentally that mushrooms growing in air containing 1% of carbon dioxide developed abnormally long, thin stalks and small caps

which opened early. He only found such concentrations of carbon dioxide in American houses when they had been shut up for 24 hours with no ventilation, and it seems unlikely that excess of carbon dioxide is a major cause of trouble in this country.

7. Rosecomb although not directly caused by poor ventilation conditions is often found where these conditions are poor. The poor ventilation allows the volatile substances responsible for rosecomb to accumulate more readily and thus increases the risk of this trouble.

8. Diseases are usually more severe where air movement is poor. This is associated with the greater difficulty of drying the surface of the mushroom. The presence of free water on the mushroom favours the development of bacterial and fungal parasites.

FACTORS AFFECTING THE ATMOSPHERIC CONDITIONS IN THE HOUSE

Air conditions in the house are a combination of the following :

1. Composition of the air. The proportions of oxygen and nitrogen do not vary appreciably ; carbon dioxide may rise if ventilation is inadequate ; the amount of water vapour may vary greatly ; other volatile products may be formed and discharged into the air.

2. Air temperature.

3. Air movement within the house.

Relative Humidity (R.H.) is the proportion of water vapour in the air, expressed as a percentage of the amount needed to saturate the air at that temperature. As its temperature rises air can hold more and more water vapour, so that it becomes relatively

less saturated, i.e. its Relative Humidity falls, although it contains the same absolute amount of water vapour ; and the air has an increasing capacity to dry moist surfaces.

Air movement is important because it affects drying and temperature changes. Moving air will dry, heat, or cool a bed more quickly than will stagnant air of otherwise identical condition. Some air movement is needed to remove heat, water vapour, and volatile products from the beds. Excessive air movement, unless the R.H. is very high, will dry the beds too quickly. No one has yet tried to reduce these general statements to numerical terms.

These air conditions are affected by the following factors :

1. The ratio of air space to bed area in the house.

If the ratio of air space to bed area is high the air can be changed correspondingly less often, probably without detriment to the crop. But if one tries to overcome the bad effect of a low air space ratio by increasing ventilation, unless the incoming air is conditioned to the right humidity there is a considerable risk of introducing too much dry air and so over-drying the beds.

2. Ventilation rate—the number of times per hour the air in the house is changed.

3. The state (temperature and Relative Humidity) of the outside air being drawn in.

4. The heating system in the house, which heats the incoming air and (except when live steam is used) thereby lowers its Relative Humidity.

5. Evaporation of water from the bed, which raises the Relative Humidity and may cool the air.

6. Evolution of other volatile products from the bed.

Air/bed ratio. The volume of air per sq. ft. of bed area has been found to exert a considerable effect on mushroom production in a house. At Yaxley and Brayton the average yield of mushrooms from three types of house was found to be correlated with the air/bed ratio. In addition the time of production of the first lb. per sq. ft. was found to rise as the yield decreased. The data are given in Table 1.

The history of No. 1 house at Brayton is of interest in that by reducing the bed area from 750 to 550 sq. ft. a greater quantity of mushrooms was produced in

the house in the ten crops after the bed area was reduced to 550 sq. ft. than in the ten crops when there were 750 sq. ft. in the house. This effect may occur fairly commonly and may account in some measure for the poor yields met with when the tray system is in use. There is no guarantee that by increasing the bed area there will be a proportionate increase in the weight of mushrooms picked. From the data available a desirable air/bed ratio should be not less than 4 : 1, that is 1 sq. ft. of bed area should have 4 cubic ft. of free air space in the growing chamber. It may be advantageous to raise this to 5 in summer.

Table 1. Comparison of three types of Mushroom House.

	Handcraft	American	Yaxley	
Length	40'	40'	40'	
Breadth	17'10"	18'4"	15'	
Height to top of chamber .. .	10'5"	14'3"	8'	
Height to top of eaves .. .	8'	12'4"	8'	
Cubic capacity of chamber .. .	6,160	9,714	4,800	cu. ft.
Area of beds	1,000	2,500	840	sq. ft.
Air/bed space	5.2	3.0	5.1	cu. ft.
Outlets :				
Total area of openings .. .	2	26	14	sq. ft.
Cubic capacity per 1 sq. ft. of outlet .. .	3,080	373	342	cu. ft.
Bed area per 1 sq. ft. of outlet .. .	500	100	60	sq. ft.
Average yield	2.16	1.61	2.64	lb./sq. ft.
Average time to produce 1 lb./sq. ft.	26	32	23	days
Difference between best and worst month :				
Yield	1.66	0.79	0.52	lb./sq. ft.
Time to produce 1 lb./sq. ft. .. .	12	6	7	days

The air/bed ratio was derived as follows :—

Cubic ft. Air/1 sq. ft. of Bed=

$$\frac{\text{Total volume of growing chamber} - \text{volume of beds}}{\text{Surface area of beds}}$$

Ventilation requirements

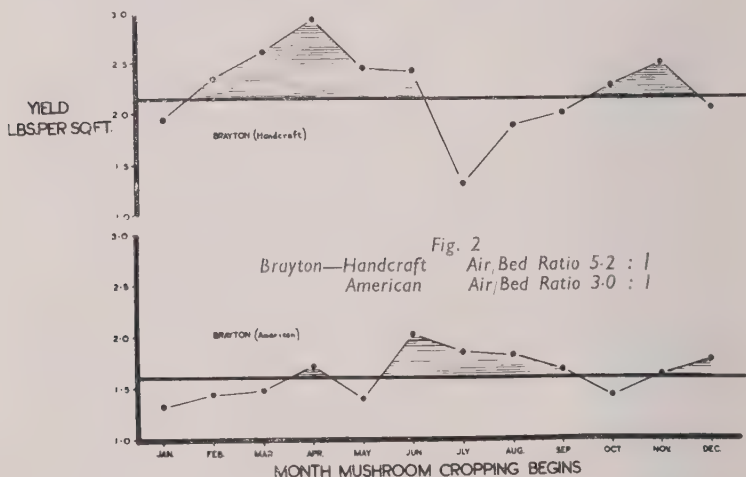
1. There must be enough movement of air into and out of the house to supply oxygen and remove carbon dioxide, excess of water vapour, and other metabolic products.

2. There must be enough circulation of air in the house so that all parts have fresh air supplied and waste products removed.

Ventilation is usually described by the number of times per hour

Effect of number of air changes per hour. When the average yield was obtained of all crops coming into production in any one type of house in each month of the year, it was found that there was a difference in the time of optimum production in the Handcraft and American type houses at Brayton.

The yield of mushrooms in the two types in relation to the month in which cropping started is shown in Fig. 2.



the whole volume of air in a house is changed. The number of changes needed in a mushroom house depends largely on the bed area in the house, because this determines the amount of waste products to be removed. Thus a house with floor beds does not need as many air changes as one full of shelves, though it does need air circulation inside the house. Some estimate of the rate of air change needed can be obtained from observed rates of CO_2 production and evaporation of water from the beds.

Fig. 2.

Whilst the difference in the air/bed ratio will explain the difference in the average yield it by no means explains the difference in the time of optimum production. The difference would appear to be related to the variation in the number of changes of air per hour at the various times of the year.

The number of air changes in the Handcraft houses is adequate so long as the heating system is in use. When this is out of action the small area of ven-

tilator opening and the very good insulation reduce air movement to a minimum unless there is a difference between the outside and inside temperatures. The poor cropping in the American type during the winter period appears to have been associated with the lack of bottom ventilator openings which prevented air entering or leaving the growing chamber.

Measurements of the number of air changes per hour have been made using a Velometer. In October, 1949, the number of air changes per hour was raised from 2 to 5 in the Handcraft houses by means of the heating system. A difference of 3° F. between the inside of the Handcraft and the outside temperature was sufficient to produce two air changes per hour. The great difficulty arises when the outside air is warmer than that inside for long periods, as happened during the summer of 1949. During this time production was very much depressed in this type of house but during the cooler summer of 1950 no such difficulty was encountered. It would appear then that at least two changes of air per hour are required for the proper production of mushrooms in houses where there is a low air/bed ratio.

Another estimate of the amount of ventilation needed can be obtained from the observed rate at which food material is consumed in the mushroom bed. This has been determined by analyses of the compost in some experiments at Yaxley.

There is a fixed relation between the amount of organic matter consumed, the oxygen

used, and carbon dioxide, heat, and moisture produced. The loss of dry matter, and with it these other changes, vary somewhat from bed to bed, but average values show that during the cropping period about 1 oz. of organic matter is destroyed per sq. ft. per week, producing $\frac{1}{8}$ th of a cu. ft. of carbon dioxide and $\frac{1}{4}$ oz. of water per sq. ft. of bed per day. It also produces 60 B.Th.U. per sq. ft. per day. The carbon dioxide must not be allowed to approach 1% of the air in the house.

About half of the heat produced is used up in evaporating water from the compost. The amount of water lost in this way has also been determined by analysis. Some of the heat may be used in raising the air temperature and some in evaporating water from the casing soil.

If, as seems probable, complete saturation of the air with moisture is harmful to fruiting, this evaporation from the bed may be important. As air can only hold a limited amount of water vapour, fresh air is needed continually to remove it.

If ventilation is adequate, say two air changes per hour, the water vapour will be continually discharged to the outside air. If there is no ventilation, or too little, it may still be disposed of in winter. Then the walls of the house are slightly cooler than the internal air, however well insulated they may be, and before complete universal saturation is reached some water will condense on the walls, the air which discharged it being reheated and so partly dried ready to take up more water.

In this way there may be a

continuous process of distillation from the relatively warm moist beds to the cold walls. This applies when there is little or no ventilation, the outside air is cold, and the heating system is in use.

In summer when the heating system is not in use, if the outside air is warmer than that inside the house there can be no such condensation of moisture on the walls, and stagnant air could become completely saturated in a few hours.

Assuming a ratio of 5 cu. ft. of air per sq. ft. of bed, the carbon dioxide produced at the rate already quoted can be kept below $\frac{1}{2}\%$ by one air change per 5 hours, but more rapid change than this is needed to take up the water evaporated from the compost and soil, which could saturate the air in the house in two hours. Therefore the quantitative known requirements for removal of water and carbon dioxide can be met with some margin of safety by providing one change of air per hour in a house with 5 cu. ft. of air per sq. ft. of bed.

During peak heating, if the manure is at all under-composted, fermentation is much more rapid and carbon dioxide may be produced so fast that two changes per hour are needed to keep it below 1%, or 1 change in 5 hours to keep it below 10%, which may be permissible at this stage.

Causes of Ventilation

Like any other object, living or dead, air does not move into, around, or out of a house without cause; this cause is a difference of pressure between two places, air moving from the point of higher pressure to the lower one.

There are three usual causes of ventilation of mushroom houses :

1. Wind blowing on one side creates a high pressure there and a lower pressure on the other three sides, tending to drive air into and through the building.

2. Stack effect. If the air inside a building is warmer than that outside, and there are openings at the top and bottom, the air pressure inside will be lower at floor level and greater at roof level than that outside, causing air to flow in at the bottom and out at the top.

3. Fans.

If there is absolutely no wind (which is unusual), no fan, and no difference between inside and outside temperatures, there will be no mass movement of air into and out of the house. There will be some diffusion of carbon dioxide, etc., through the air but this is relatively slow process, much too slow to be of any use.

Air needs both inlets and outlets, and the rate of ventilation is limited by whichever of these is smaller. For example in a house ventilated mainly by stack effect, without wind or fans, large roof vents have little effect unless those at floor level are the same size. Air is circulated inside the house if the inlets and outlets are at opposite sites in the house, e.g. floor and roof or opposite ends.

Excessive ventilation

It is possible to have too much ventilation which can have several bad effects :

In very cold weather it over-cools the house.

In very hot weather it overheats it.

It is liable to cause draughts, drying the beds unevenly; this makes watering more difficult to judge.

In many conditions of weather it will dry all the beds too quickly; for this reason it is not safe to rely on increased ventilation to overcome the effects of having too much bed area for the air space in a house.

The volume of air per hour passing through an opening is directly proportional to the cross sectional area of the opening. The effective area of a ventilator covered by any kind of screen is reduced, for example a common type of perforated zinc has only 40% openings and 60% metal. A ventilator of 10 sq. ft. covered with this material is equal to an unscreened ventilator of 4 sq. ft. **But** if the air has to pass through two openings of different sizes, such as a small inlet at floor level and a large outlet in the roof, the rate of flow is determined mainly by the smaller opening.

The most efficient arrangement is to have floor level inlets and roof outlets of equal size.

Summary

Mushroom beds must breathe and production can be reduced or stopped by lack of air.

The amount of air needed, in terms of air space and rate of ventilation, and the causes of air movement are discussed.

There must be enough air space in the house in relation to bed area; probably 4 cu. ft. of air per sq. ft. of bed. The air must be changed often enough, probably twice an hour is a safe figure. These two are related; a high air/bed ratio may tolerate a low rate of ventilation, but too

great a departure from the suggested values is likely to introduce other difficulties.

Ventilators must be so placed that air can move freely into and out of the house. There should always be some at floor and some at roof level; it is probably beneficial to have them at both ends of the house. They should be adjusted to use any wind as well as the "stack effect" due to the heating system in the house.

They Bind our Bulletins

Our printers, Messrs. W. S. Maney & Son, make a fine job of binding each year's four Bulletins, with a strong cover blocked in gold and with a comprehensive Contents List just inside. Despite recent heavy increases in costs, their charge is only 10/-, including postage. Members wishing to have their Bulletins bound should send them direct to Messrs. W. S. Maney & Son, Russell Street, Park Row, Leeds 1.

Congratulations to Dr. W. K. Slater, Secretary of the Agricultural Research Council, who received a knighthood in the Birthday Honours List. Dr. Slater was our Guest of Honour at the Mushroom Lunch two years ago, and on that occasion remarked that an Association such as ours, where we had a close personal interest in research, was of enormous value.

Fred. C. Atkins

Thinking It Over

Complex Costing Comparisons

*The writer with
Professor A. Willam
(Courtesy G. de Man)*



I suggested in July that these were tricky times. They are certainly very complicated. At any rate I find them so.

Having planned for the Mushroom Industry during my year as Chairman a heavy programme, I found it imperative a few weeks ago to take a brief holiday and relax!!!

Motoring across Belgium with my good friend Guy de Man, I pass through the old University town of Louvain with its young bearded Catholic priests, through Hasselt and Eben-Emael (which suffered such frightful destruction when the Germans broke through at that point in 1940), and into Dutch Limburg, made picturesque by the womenfolk walking their solitary cows along the roads on a lead. We leave behind the cleanliness of old Maastricht and take the road to Arnhem, the German frontier fearfully close.

But at Mook, who is this,

smiling at us through his spectacles, blushing a little, in the maroon blazer known throughout the mushroom growing areas of Europe, resting his umbrella before him in the shattering heat? . . . Another old friend, Pieter Bels.

Dr. Bels takes us along to De Plasmolen, an astonishingly good hotel which calls itself a "badhotel." (I gather that "bad" here indicates the presence of a bathing pool).

Some hours later, having contrived to rise from our table, we dutifully return to Mook with the one mushroom personality who never permits pleasure to interfere with business, and soon we are inspecting the new air-conditioned cropping houses there, criticizing a little, praising much. One of the three we visit is at peak heat, and two of us flounder through the steam to examine the beds. I wait outside —130° F. plus 100% R.H. have

no appeal on holiday—and cogitate sadly upon the friendly concern of well-fed Continental waiters when they learn that one is English.

I will not spoil a pleasure to come by attempting to describe those advanced houses, for I tackle Bels as he emerges from his Turkish bath and make him promise to describe and picture them in a future M.G.A. Bulletin. But this much I will say: Those houses cost £1 per sq. ft. to build and equip, yet they produce mushrooms at 1/6d. per lb.

At any rate, those are the figures which are resolved from a translation of kilograms into pounds weight and guilders into shillings. And this is where the complexities of costing occur most forcibly to me, for I begin to discuss American production costs.

In the United States, according to Al Kligman, there is no profit on a 3-pound basket of mushrooms sent to market until the price passes one dollar and forty cents. At the present rate of exchange this means 10/- for 3 lb., or 3/4d. per lb. Were you aware of this? Did you not think with me that the Americans grew much more efficiently than we did?

There has been some talk of re-valuing the £ from 2.80 to 3.20 dollars. Such a step would mean that a measure adopted by our Government would reduce the comparative marketing cost of American mushrooms from 3/4d. per lb. to 2/11d. Or would it? Perhaps those of you who comprehend these complications will explain it to me.

You can imagine my relief a day or two later when de Man, a founder member of the Belgian

Mushroom Research Centre at Gembloux, took me along to meet Professor Willam, who said at once: "Our major problem at the moment is not the cost of production but the reason mushrooms grow." This was more in my line, and we forgot our lunch as we discussed in detail the many composting problems involved in research work.



Monsieur G. de Man

A beginning has been made on this £2,000 p.a. programme, and I was shown the growing cellars (confusingly referred to as "caves," whereas cave in French is "carrière"). Admirable they are in every way. And very promising too is the first issue of their Bulletin.

There still remain in England those who deplore discussions with growers abroad. I can assure them that the French, Belgians and Dutch will soon be able to give us some information of very great value. I propose to continue to work for even closer liaison, and confess that the memento of my 1951 holiday of which I am proudest is a little card appointing me the first overseas honorary member of the Centre de Recherches sur les Champignon—more briefly, Cerec.



(Courtesy "The Grower")

Angus Watson on

OLYMPIA 1951

Everything that could be said has been said about the National Market Produce Show at Olympia on 27th—29th June, but because it was the first real effort of the M.G.A. to exhibit at a national show I would like to talk about it from our own point of view.

We went to meet the public, of course, and by the time the Show opened we were ready to slay dragons—but no dragons appeared, and very few members of the public either. And so it continued for the three days. We are not interested in the reasons given for the poor 'gate' so I will turn to the credit side of the show as it affected the M.G.A. Our stand was a good turn-out, the literature on show attracted attention and the quality of the mushrooms was such that we on the stand had trouble keeping an eye on them! The most important gain was that we learned a great deal about shows in general, how to go about them, what to do, the type of questions likely to be asked by the public, and what to do to interest them. The

general observations of this Show have been laid before the Publicity Committee and we should start seeing the benefit in next year's M.G.A. Trade Show at Worthing (provisional date 5th March, 1952).

The public were interested in the recipe leaflets; again we did not get rid of as many as we hoped but that was because our visitors were fewer than expected. By the way, those of you who were generous enough to contribute towards the Olympia Fund may purchase these recipe leaflets at £2 per 1,000; the normal price is £4 per 1,000. One suggestion is that you stamp each leaflet with your trademark, thereby gaining some personal advertising as well as supporting the national effort.

It is obvious that the public are interested in mushrooms, although quite ignorant of the subject. Our job is first to contact the people and then to talk sense about our Industry. Financially Olympia showed a small M.G.A. loss; the future alone will reveal just what credit we got out of it.

Philip Harben discusses

The Cooking of Mushrooms

This is the first of a series of four articles on the preparation and cooking of mushrooms which your Editor has asked me to write for this journal. I approach the task with considerable trepidation and the liveliest anxiety. On the one hand it seems to me more than probable that your enormously greater experience of mushrooms, and opportunities for using them, must make your knowledge of the cooking of them far better than mine. On the other hand it may well be that you never wish to eat another mushroom again !!

In this article I will deal with the basic methods of cooking mushrooms, the foundations of all the manifold and varied guises in which they may appear on the gourmet's table. In my second article I will deal with the mushroom as the principal or highly important ingredient of certain main dishes including one which, though I learned it from the chef of the most expensive restaurant in the world, yet costs only a few pence. In the third instalment (if you shall have borne me for so long) I will discuss the rôle of mushrooms in those dishes in which they appear not as the main theme but as grace notes in the accompaniment, yet having the power withal to transform with their magic touch the banal into the beautiful.



(Photo.: ROGER HARBEN)

My last article will be devoted to a really full and detailed recipe for Mushroom Soup—perhaps the best of all mushroom uses, and perhaps the finest of all soups; especially when it is made, as you growers can make it, with unstinted abundance of the very freshest Fungi.

The preparation of mushrooms is very simple: they do not need any preparation at all. Equally simple is the cooking of mushrooms: they do not need any cooking at all! The wild mushroom may perhaps need peeling to remove undesirable contaminations; but the pure, pearly cultivated *psalliota* needs hardly more than a wipe, if even that. As for the cooking of them, they are unbeatable raw.

Be that as it may, the three basic ways of cooking mushrooms are:

(a) in liquid; the simplest and perhaps the best of all ways of cooking mushrooms is to divide them into pieces no larger than sugar cubes and cook them in hardly any boiling salted water or milk, in a covered pan. (This is the conservative method). A couple of minutes is sufficient.

(b) in fat. In other words

frying. Mushrooms can be shallow fried, or deep fried in batter. Fried without batter in direct contact with fat they absorb a lot of it (more when they are stale) so the quality of the fat is important. Butter is the thing. Just enough cooking to colour the surface is enough.

(c) by radiant heat—grilling. This method, though simple and effective, tends to dry the mush-

rooms, especially old ones, and it is therefore best to grill them in association with chops or bacon or something to yield fat or liquid.

In the articles that are to follow the cooking methods will become far more elaborate, but it is doubtful whether any of them will show the fungi to better advantage than these simple basic ways of doing them.

FRENCH GROWERS' CONGRESS

In 1939 the French Mushroom Growers' Federation held a very successful National Mushroom Congress. The work of the Federation was severely disrupted by the war, but it has now recovered so well that a Second Mushroom Congress and Banquet was arranged for 5th July, 1951. In announcing this Congress, M. Guiochon, President of the Federation, said that production of mushrooms in France has reached the pre-war level, thanks to the development of new sources of manure. Methods of growing have reached a turning point with the establishment of research stations in several countries.

A new Experimental and Research Station has been set up at St. Cyr by the Federation with the help of the Government. It is particularly suitable that this should be done on the sixtieth anniversary of the foundation of the Federation. Many of its founders are still represented in the Federation by their descendants.

After the Banquet members visited St. Cyr where experiments are already in progress on the popular French practice of boosting manure with various proportions of sulphate of ammonia, and on the use of dried blood, urea and fish meal for this purpose. The experiments are carried out in trays; a heat room has been built, with automatic control of temperature and humidity, and will soon be in use. Future experiments are planned to study the effect of cutting straw or strawy manure, the use of manure from different animals, supplements to manure, and casing soils.

Many French growers have already carried out extensive experiments, with some interesting results.

(Some of these were described to the International Conference held at Peterborough in May, 1950.)

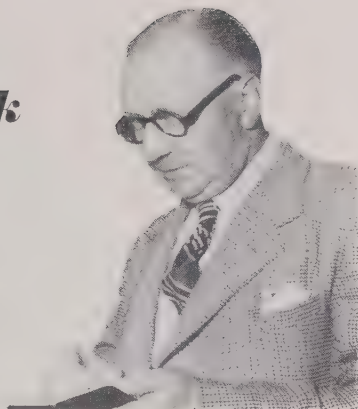
Progress at the French Experimental and Research Station will be watched with interest by all concerned with mushroom growing.

R.L.E.

Mr. Middlebrook

Consults

His Diary



June 23. There is much to be learned about the welcome and hospitality that should be offered by the mushroom grower to his fellow sufferer. This morning I had exactly $1\frac{1}{2}$ hours to "go over" a farm. As I approached the farm a wave of enthusiasm overcame the owner as he leapt with much relish and apparently great relief from the midst of his steam-ridden composting. His first words were most encouraging: "Come and break a bottle of champagne, Old Boy!" Assuming he jocularly meant beer and the time being 9.30 a.m., I readily concurred. The "beer" really *was* champagne, and by 10 a.m. the bottle was of no further use. During the next hour we "did" the farm, at least I suppose we did. Anyway I've since learned that I ladled out advice and dogmatized on this and that to such effect that where mushrooms would not grow and temperatures would not rise there immediately followed a flush of activity from which immense financial advantages have accrued. The moral seems clear: where Middlebrookian advice is needed it must first be stimulated! The process may be expensive, but benefits would appear to be mutual.

June 28. A tip to those thinking of buying secondhand all-steel low pressure boilers DON'T. Once the inner shell starts going and welding has to be started, the boiler is practically immediately written off.

June 30. Thus grumbles "Retailer" in *Fruit Trades Journal*: "A wholesaler offered me mushrooms at 6/6 per lb. which I refused. He then came down to 6/-, I again refused. After buying my requirements he finally offered me at 5/6 when the market was 3/- to 4/- per lb. If he made a profit at 5/6 why try to charge 6/6? In addition to this no boxes of mushrooms are reputed weight—one I had this week was supposed to be 3 lb. but turned out to be 2 lb. 10 ozs. Growers in Britain should take a lesson from foreigners who grade all their produce." Whoever read such nonsense! The wholesaler was only doing his job of trying to lift prices for his sender. Is there anything wrong with that? If wholesalers slackly let prices fall, or make no attempt to raise them, how long would they have senders? How long would there be any growers? I congratulate the wholesaler in question. Equally I applaud "Retailer" for not buying. That is how the law of supply and demand

works. Long may it continue so. But please, "Retailer," don't grumble at the man for trying to satisfy his producer. As for the grading grumble, mushrooms are notoriously quick to lose weight. Baskets are usually sent "nett weight when packed," which is assumed if not stated. If "Retailer" can suggest weights the grower should put into a 3 lb. basket to guarantee 3 lb. being in it after say 1, 2, 3 and 4 days keeping, and devise a method of telling the grower how long each and every basket is to be kept, we shall have more respect for his constructive action than for his silly, childish, immature observations as quoted. How in Pete's name would grading maintain the moisture (hence weight) of a mushroom?

July 1. Someone writing in *The Grower* states that the practice of including granulated sphagnum moss peat in the casing soil seems to be growing rapidly, adding that a 50% increase in yield has been a common result. Surely all this has been tried before many times and **without** a 50% increase in yield. How common is the practice becoming and how often has it produced a 50% increase?

July 3. Also from *The Grower*. T. B. Brook, an old friend of mine in this mushroom business, goes into a mystical trance when he writes: "I think that more emphasis might be placed on **lowering the cost** of mushroom production a square foot and less on the yield, if the cost of obtaining that yield is going to be exorbitant." As Yorkshiremen both, we usually say what we mean, but does T. B. **know** what he means here? If he **does**, and if **I** do, I must disagree. A 10% increase in yield, for instance, brings returns out of proportion to a 10% saving in cost. If you can get 100 extra lbs. of mushrooms for 100/- extra cost, you are surely into pocket. If you cut £5 in cost you might easily lose far more than £5's worth of mushrooms. If T. B.'s idea is to lower the cost and (somehow) double the yield, I am with him and, to maintain the balance of the argument on one plane, would give him a fiver to keep the secret to our two selves.

July 17. How's this for a comprehensive note on a savoury theme? "Mushrooms add a delicious flavour to your pot-roast or, simmered in butter with a little onion and parsley, they may be eaten as a vegetable. If you add a dash of cream, you will have a highly delectable dish, the mere thought of which makes my mouth water. Even the commonest of stews will acquire an almost aristocratic *aroma* if mushrooms are added, and ordinary scrambled eggs, when savoured with mushrooms, can make your breakfast the outstanding event of the day They may be pickled in vinegar or cut into thin slices and salted to form a piquant condiment for serving with cold meats." (S. F. Hurst in *Cape Times*, March, 1951).

July 19. A local builder, interested in our ventilation problems, has produced some drawings of a house for my consideration. It has two flat roofs with a 4" air space sandwiched between them. Into the lower half are fixed about 500 vertical 2" or 3" diameter pipes, opening into the house (house area 18' × 40'). In effect the lower roof is a sieve. The air space continues through to the ends of the house thus permitting the air which comes through the "sieve" to escape. Suitable ground ventilation is provided by ducts in the floor, which are controllable and also act as channels when washing down. The

whole idea has its points but needs developing further. The general scheme, clearly, is to get a uniform distribution of moving air.

July 22. A swarm of bees in the top of a bedroom chimney has caused a week's diversion from mushrooms. No bee-keeper, nor even technically-minded mushroom grower—F. C. Atkins was staying here at the time—seemed to know how to deal with it as it was impossible to “take” a swarm from that position. Many newspapers and about half a bale of straw were burned in the grate with no other effect than the rapid descent of a few hundreds of frizzling bees. The bulk remained with the queen. My cure-all—Gammexane—proved worthless. At length the technical mind awoke and aroused itself with a typically categorical and final compression of thought into the maxim, “DDT for bees.” We tried it. The bees laughed! At last, for one occasion at least. Atkins and Middlebrook found agreement and doubled up on previous efforts by setting off two Gammexane and two DDT smokes simultaneously. Garden and lawns outside assumed an insecticidal deposit white as a late fall of snow, the air became bee-loud, and the chimney was clear! No second flush is expected.

August 8. The tray controversy goes on. One man I know—a good 3 lb. man in his shelf days—cannot average more than 1 lb. per sq. ft. Another swears by his trays and his 2 lb. crops; he has even claimed a 3 pounder, I believe.

August 9. I wonder if we fully understand the conditions governing moisture retention in composts at different seasons. It seems to me a compost loses less moisture in summer than winter. On a hot, dry, airy day this is hard to believe and unbelief may lead to disaster, as we know to our cost at Brayton. Equally, less evaporation takes place during cropping and there is constant danger of over-watering. In this matter a little knowledge (of ventilation) may NOT be a dangerous thing.

August 12. With a complete blank from 22,000 sq. ft. to-day I am humbly reminded that 15 years ago this month I sent to Cövent Garden my first mushrooms—one 5 lb. basket. How proud I was! Prouder still when shortly after we spent the whole of a day picking, brushing and packing with the utmost satisfaction and self-congratulation our largest consignment to date—13 lbs.!

August 15. Being compelled, by shortage of stable manure, to start on synthetics, I visited a farm to-day where the M.R.A. compost is being used very successfully. I was brain-picking, even as I have too-often been brain-picked. My chief finding was that synthetics provide the same variation in results as stable stuff. Though one starts with a fairly standard product every time, hundreds of things can go wrong even before one starts on the normal troubles of bed management after casing. Producing the correct moisture in the straw base and through composting is, I gather, one of the main difficulties.

August 17. I was recently visited by a bus load of young farmers—mixed male and female. The whole trip round the farm took less than half an hour, as only the elementary process had to be described and shown. I noted the female element was almost 100% uninterested except where mushrooms were to be seen growing. “Let’s be going home,” I heard one girl say, “there’s nowt to see.”

KENT BRAINS TRUST

On Saturday, 14th July, 1951. the 'go-ahead' Kent/Surrey/E. Sussex Area Group again held one of their highly successful meetings, this time in the form of a "Brains Trust" at the Amherst Arms Hotel, Riverhead. The members, who numbered 37, with their wives and friends, started assembling at 4.30 p.m. and the meeting commenced at 5 p.m.

The guest Question Master was Mr. J. E. R. Simons, of Harlow, who, with the team composed of Messrs. H. H. Glasscock (N.A.A.S., Wye), G. V. Allen (Ashford), A. DeB. Hovell (Worthing) and H. G. Boxall (Worthing), was introduced to the members by the Area Chairman, Mr. G. W. Baker (Oxted).

The subjects covered ranged from the cause of small mushrooms to the food value of the mushroom and included the following: Ventilation, temperatures, heavy versus light manures, pig manure, dangers of over peak heating, stroma, spawn and sterilization. The brains trust battled manfully with these problems and were no doubt very glad of the break which came at 6.15 p.m. for refreshment!

Later the meeting was thrown open to a general discussion on the Tray System and the policy for future meetings.

Mr. R. Darlington (Worthing), the only member present growing extensively on the Tray System, gave his reasons for and against. In his case the trays were a better proposition because he could now guarantee a peak heat and also more cropping area per house.

The Question Master thanked members for turning out in such good numbers and Mr. H. N. Ball, for the members, thanked the Area Committee for arranging the meeting, the Question Master for his able handling of the day, and the "brains" for their excellent contribution to the success of the evening. Mr. Hovell thanked the meeting on behalf of the "brains."

This officially ended the meeting, but for a very long time afterwards small groups of earnest and excited growers could be seen in odd corners of the hotel—the one common subject being the mushroom!

According to *The Grower* (4.8.51), one question, "Is the M.G.A. worth four guineas?" was answered by Mr. H. G. Boxall (Worthing). He said growers in the Worthing area were well catered for by their own Association but that did not apply to the rest of the country. In any case the publicity work being done by the M.G.A. was worthy of the support of all growers.

The Government had taken a very good view of the work done by the M.G.A. in the grading field which had been accepted *en bloc* by the Ministry's Committee.

Mr. G. V. Allen (Kent) said that one had only to be in trouble, a not uncommon thing for a mushroom grower, to realise the need for a strong and helpful association.

Mr. J. E. R. Simons stated that in his experience of many years in publicity and advertising he was convinced that the moral and publicity value of the M.G.A.

DUNLEY HALL FARM WALK

A most successful "walk" was held in Worcestershire on Wednesday, 25th July. Sir Thomas Lea and Mr. John Lea very kindly agreed to show M.G.A. members round their admirably planned farm at Dunley Hall. There are not many growers in this part of the world, and the 20 who turned up included Dr. T. H. Rose's party of N.A.A.S. advisers.

The programme might well serve as a model for future walks, in whatever area they are arranged. We met at noon in the lounge of the Elms Hotel, Abberley, and introductions all round were effected over drinks. A first-class lunch followed in a private room and was brought to an exciting close with a savoury (which does not appear in "Mushrooms Galore"). Medium flats are dipped in batter and dropped into really hot fat for (I think) half-a-minute. They are speared with a cocktail stick and served cold around a bowl of piquant sauce. They proved delectable at Abberley.

We arrived at the mushroom farm and found an expanse of concrete which immensely gratified those of us who for years have advocated it as a basic essential. Everything was spotlessly clean; even the mycologist among us remarked that had he not already lunched well he could have eaten from it.

The long-straw compost is fortified, turned mechanically four times, placed in galvanised baths, and run along a narrow-gauge railway right into each five-tiered house. Peak heats of 130° F. are attained in 30 hours and the rising temperatures are permanently recorded **outside** the houses. Emptying is simplicity itself But I have said enough to whet your appetites for a forthcoming article which, suitably illustrated, has been promised for a future Bulletin.

I had the pleasure of expressing the most sincere thanks of the company to the brothers Lea for a most enjoyable and enlightening afternoon. F.C.A.

Continued from previous page

alone was worth the subscription.

Mr. A. DeB. Hovell (Worthing) thought there was much to be said for the policy of keeping one's knowledge to the home market and not distributing information abroad to competitors,

but he was well aware that our growers had also obtained much help from overseas; he was one of the founders of the M.G.A. and firmly believed in the work it was doing.

RESEARCH FUND, 1951

£300 Short of Target

Despite the fact that prices have held remarkably well this year, the Research Fund is £500 behind the sum subscribed in 1950, and another £300 is required before the current target is reached. It is sincerely hoped that those who have not yet subscribed for 1951 will do so as soon as possible. Research cannot continue indefinitely without funds.

The warm thanks of the Directors are accorded the following who subscribed up to 10th August, since the last Bulletin went to Press :

	£	s.	d.
Coulson, H. L.	10	0	0
Lambert, L. F. (U.S.A.)	10	0	0
Smith, W. D.	7	0	0
Jones, Capt. W. Piers	5	0	0
Orritt, T.	5	0	0
Simons, J. E. R.	4	4	0
Speller, R. L. & R.	4	4	0
Moeykens, A. (Belgium)	3	0	0
Robotham, A. (N.S.W.)	2	17	6
Barton, H. F.	2	2	0
Svendsen, K. (Denmark)	1	17	0
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Partridge, A. B.	1	1	0
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J. R. ASHTON writes in "The Grower" of 31.3.51 on RHUBARB v. MUSHROOMS

Rhubarb and mushrooms are bad bed-fellows. Not by choice, but for a variety of reasons, we laid half a house of rhubarb alongside a bed of mushrooms early in December.

Soon after the first flush, when the rhubarb was just ready for picking, the mushrooms packed up. In the next house, with the same compost and treatment, the shelves were turning out a good crop.

This puzzled me for a time, until I remembered that Atkins, in his book on mushrooms, had something to say about carbon

dioxide. I looked it up, and this is what he says :

"The growing mushroom requires much oxygen, and in exchange breathes out carbon dioxide which, if allowed to accumulate until it constitutes 5 per cent. of the air in the house will almost certainly bring growth to a standstill."

The rhubarb was turning out carbon dioxide night and day, and though I realised the mushrooms would need plenty of ventilation, enough could not be given without lowering the temperature.

Now that the rhubarb has finished, mushrooms are appearing again.

The "Fruit Trades Journal" of 28.4.51 carried this stimulating article which is reproduced with the Editor's permission :

SELLING MUSHROOMS

Ironing out price fluctuations by popularising a luxury

Though the movement of mushrooms over the whole country remains fairly steady, there appears to be a general feeling in the trade that sales are a long way behind what they should be considering the general shortage of meat and the high price of other food. Hotels and restaurants probably take their weekly share regularly, but it is amongst the ordinary public that sales appear to make no headway. Family traders will tell you that they know to a pound how many to order each week from the wholesaler, so steady is their mushroom trade ; that the same people buy the same quantity each week on the same day ; and that the same quantity is consumed by the same people all the year round whether the price is 4s. or 12s. a pound.

Such customers are grand, but movement in the trade is altogether too slow and shows no general increase in volume. The position warrants some attention at the hands of all sections of the trade.

What is the cause of this non-expansion of the mushroom trade outside the accustomed channels? How is it that the general public, represented by the ordinary housewife, does not buy more?

ONLY A LUXURY TRADE

In the first place mushrooms were always regarded as a luxury and eaten only because people liked them—liked the flavour—but the food value was, to a great

extent, both by the public and the trade, disregarded. People do not mind paying a high price for an occasional luxury if what they buy is something they like, but people do not think of the mushroom as a valuable article of everyday diet. Two facts operate against its popularisation. One is the fluctuating price and the other lack of information on the matter of food value and cooking. The Mushroom Growers' Association should do something towards steadying retail prices throughout the year, and disseminate information on food values.

The M.G.A. has done a good deal to help growers since it came into existence only upon the ending of the last war. But on the sales side not enough has been done so far to remove the stigma that the mushroom is merely an expensive luxury possible for the rich only and possessing little or no food value.

Like the cucumber, the mushroom received a serious setback during the war, as has been pointed out by Mr. Fred. Atkins, when the Ministry of Agriculture decided that they not only possessed no food value as a food, but that they competed with the more favoured vegetables for the limited supply of fertilisers. It is true that in the past the grower has endured much hardship through the mistaken official impression that mushrooms have no food value, and coupled with the fantastic prices reaching 12s.

per lb. wholesale on several odd days during the war it was not surprising that the cultivated mushroom was dismissed as a non-essential luxury.

A VALUABLE FOOD

The food value of the field mushroom has been known to country people for a very long time. People have always been able to select for eating those natural foods that are good for them. But the cultivated form is now accepted as much richer in actual food value than the field kinds, and, of course, the flavour is different.

As a result of representations by the M.G.A. the Ministry of Agriculture now recognises mushrooms as a food crop. Mr. Atkins states that on a dry weight basis mushrooms are richer in protein than any comparable fruit or vegetable, and can claim to be a protective food, containing Vitamin B1 and several members of the B2 complex, including nicotinic acid and riboflavin. They are an excellent source of folic acid, the blood-building vitamin which counteracts pernicious anaemia. Folic acid was at one time thought to be confined to spinach, kidney and raw liver, but doctors now place mushrooms in the same category.

There is the question of mushroom cookery. Very few people know how to use mushrooms in the household, but very many ways exist of cooking and eating them beside fried on toast or with bacon.

Retailers should certainly be able to help their customers with recipes. I do not know whether the M.G.A. supply copies. If they do not it would pay the retailer to provide them himself.

HOW TO POPULARISE MUSHROOMS

The most immediate way for the retailer to help to popularise it, however, and incidentally promote his own mushroom sales, is by price ticketing them in the window or in other display positions. Why is it that so many retailers fail to do this? One may pass shop after shop with other things priced in the window but not the mushrooms.

Are there still retailers who do not realise that when a special article like mushrooms or asparagus are not ticketed members of the public immediately conclude the reason is the high price which the retailer is afraid to display?

If mushrooms are 6s. a lb. mark them so. If they are 4s. do the same. It will promote sales, especially at the latter price of 5s. Mushroom vendors should not lose sight of the fact that a very serious meat shortage is impending and that the mushroom reasonably priced is a good substitute for meat.

Much more uniformity in retail prices is needed. The other day two retailer friends of mine bought the same grower's mushrooms from the same wholesaler, at the same time and at the same price. Neither ticketed them on display, but the one charged 6s. a lb. and the other 5s. Both shops, though not in the same district, were similarly situated and there was no reason whatever for one charging 1s. a lb. more than the other. And I will bet they would both have sold more had they marked them with the price.

L. M. MARSHALL.

In a subsequent issue appeared the following reply from Mr. J. E. R. Simons :

As Chairman of the Publicity Committee of the Mushroom Growers' Association I was naturally very interested indeed in your most excellent article, "Selling Mushrooms," of 28th April.

Having had great experience in the technique of selling, I must admit that this Mushroom Sales business has always intrigued me and as a matter of fact, I have, during the last few months, endeavoured to get some ideas together with a view to formulating plans in relation to increasing the sales of Mushrooms.

It always seems rather extraordinary that so many people profess a desire and liking for Mushrooms and yet up to date no propaganda seems to be available at all telling them how to get Mushrooms and what to do with them.

Added to your Family Traders' statement that the same people buy Mushrooms every week it is I believe also a fact that the majority of Mushrooms are sold in quarter pounds, so it would seem that the unit value or purchase might play an important part in the greater consumption of Mushrooms.

Personally, I believe that we

have got to get to a stage where the housewife thinks about her quarter pound purchase of Mushrooms in the same way as her pound purchase of Tomatoes.

However, your readers will no doubt be interested to know that we are already formulating plans for the publishing of recipes. Only this week a new book, entitled: "Mushrooms Galore," being a collection of Mushroom recipes by André Simon, President of the Wine & Food Society, is to be published and I have requested our Association to forward a copy to you.

Our Publicity Committee has also made arrangements to print tens of thousands of recipe booklets for distribution at the Olympia National Produce Show. Several of our Grower members are considering putting these recipe booklets in the Mushroom baskets so that in due time the Retailer will have an opportunity of handing them out to his customers, particularly those who are not yet Mushroom minded.

Perhaps the retailers would like to take a part in this distribution of information on "Better Ways of Eating Mushrooms?"

We have several other schemes afoot and it does occur to me that possibly a few of our Retailer friends may like to put forward their suggestions.

WHO'S THAT FELLOW ?

At many of the better-organised conferences the delegates wear identity badges on their lapels. These enable them to introduce themselves informally and to know at once who So-and-So is, and obviate a good deal of embarrassment. Special M.G.A. badges are obtainable, printed with your own name, for 5/-; they will be particularly helpful at all M.G.A. meetings.



How Much Soil pH and Lime

by P. B. FLEGG, F.R.S.

One of the attendant problems of mushroom growing is that of ensuring a satisfactory pH value in soils used for casing. However, unlike so many problems in cultivating mushrooms, it is one which can be easily and satisfactorily dealt with.

It is the purpose of this article to review briefly the factors governing pH and the lime requirements of soils.

The pH of a soil is a measure of its acidity or alkalinity. A pH value of 7 indicates neutrality; values 7-14 indicate alkalinity, and below 7 acidity. It is important to realise that the scale is logarithmic, that is to say, a soil of pH 5.5 is ten times more acid than one of pH 6.5.

The pH of a soil in the field varies with time. The chief factors which operate to cause such changes are:—

1. The addition of fertilisers, etc., e.g. lime, ammonium sulphate.
2. A growing crop. This will remove basic elements, causing the soil to become acid.
3. The effect of rain. The continual draining of rain water through the soil leaches away basic elements such as calcium and the soil gradually becomes more acid. This is by far the greatest factor causing soil acidity in the country, as much as 2.5 cwt. of CaO per acre being lost annually.

These factors are not so important when subsoil is used for casing, but where top soil is used it must be realised that there is a general tendency for the soil pH to change.

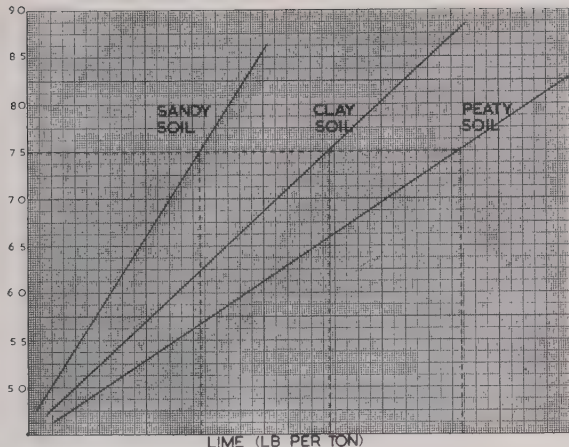
Thus there is a need to add lime to soils at fairly regular intervals. The generally accepted optimum pH for crop plants is 6.5, which is slightly acid. For casing mushroom beds the evidence pointing towards an optimum is not so overwhelming, but the M.R.A. recommend a soil pH of approximately 7.5.

All soils possess to a greater or lesser extent a property known as their Buffering Capacity. A sandy soil has a low buffering capacity, that is to say less lime is required to raise the pH one unit than in a more highly buffered soil such as a clay. This is shown simply in Diagram 1,

ime ?

requirements

A. Chemist



It will be noticed that a soil containing a high proportion of organic matter or peat is even more highly buffered than a clay soil, thus requiring much more lime to raise its pH one unit, say from 6.5 to 7.5.

Thus, in order to assess the amount of lime needed to bring a soil to a desired pH, it is necessary to know :

1. The pH before liming ; it may be already at the desired value.
2. The buffering capacity of the soil.

The method of determination of the lime requirement used at the M.R.A. laboratory is to take ten gram samples of the soil and add to each increasing amounts of calcium hydroxide solution (slaked lime). These mixtures are well shaken and time allowed for the lime and soil to reach equilibrium. The pH of each sample of calcium hydroxide required to bring the soil to pH 7.5 is read off and converted into pounds per ton of soil.

The M.R.A. recommendations are usually given in pounds of ground chalk per ton of dry soil. However, other forms of lime are available :

1. **Quicklime, or calcium oxide** : This is generally unsuitable as it is usually supplied in large lumps and has to be broken down and slaked by the addition of water. This, if not done carefully, may be dangerous.

2. **" Slaked " lime, hydrated lime, or calcium hydroxide** : This is usually in powder form and can be evenly mixed with soil. When added to a soil the pH rises sharply, possibly to 12 or over. With the action of carbon dioxide from the air and beds this is converted to calcium carbonate and the pH drops. It is safer to allow the soil to ' weather ' for a day or two before casing.

3. **Ground chalk, carbonate of lime, or calcium carbonate** : This is very suitable ; being ground it can be more evenly mixed in the soil and the pH will not rise sharply as with the two previous substances.

It must be realised when using these substances that they have not equivalent neutralising values.

Approximately 1 lb. Ground Chalk = $\frac{3}{4}$ lb. Slaked Lime = $\frac{1}{2}$ lb. Quicklime.

SOME ASPECTS of the TRAY SYSTEM

3—Crop Management

by

Captain Giles Tweedie

Picking. I still delight in my miner's lamp, worn on the head. I consider it THE way to light trays—a concentrated beam wherever the operator turns, avoiding the shadows inevitable with fixed lighting and the time-wasting re-setting of portable lamps.

I still imagine we can pick shelf beds faster than trays—even though Dr. Sinden suggests I am wrong. How I curse those bottom trays! With perseverance one should become the possessor of abdominal muscles second to none, for there are at least five stooping positions, at each column of trays!

Ventilation. This involves tray growers in much worry and discussion. However much controlled ventilation we admit into our growing structures, it is of little use unless it passes freely between the trays. Semi-stagnant air pockets are a problem there. Dr. Edwards advises ends higher by 2 inches than sides. I would prefer to get this height by corner-pieces projecting 2 inches above the ends and sides, which could then be the same depth, saving timber. This is not **my** patent, of course. Ventilators along the sides of the house would help, too, provided draughts were not troublesome. It has also been suggested that the trays could be stacked sideways.

Air/Bed Ratio. We have repeatedly recorded that our Hand-crafts (which are of the correct

capacity to house 1,000 sq. ft. of shelves) crop faster, and more weight is taken off per sq. ft., when we fill only 1,000 sq. ft. of trays. Indeed, I have on two or three occasions taken a greater **total** weight off 1,000 sq. ft. than out of the same house with 1,250 and 1,300 sq. ft., cropping for the same duration and with no apparent cultural differences. I definitely dislike filling 1,500 sq. ft.; all my partial failures have been at that level.

Watering. I was privileged and delighted to receive a visit the other day from a distinguished Northern grower. We looked in on some shelf beds which I did not expect to do anything for 10 days at least. He politely mentioned he considered them dry. I thought them to be at the ideal moisture, but after he had departed I gave the beds such a douche that the casing resembled the mud at the bottom of a pond. Thirty-six hours—and what a flush! “Thank-you, and please call again soon, Mr. Middlebrook!”

We **have** to be careful watering trays. For one thing there is less time to put things right if we water carelessly, and there is the mechanical difficulty of getting the water on evenly. Experience, manual dexterity and an even water pressure are all required.

Trashing. We trash and fill in after each picking for the first month. For the next three weeks we do as much as we have time for. How any plant, **unless on the**

most vast mechanised scale, can pay its way where NO trashing is the order of the day I cannot fathom. But then I am neither American nor opulent.

Clearing Out. Obviously this operation is much simplified with trays. Roller conveyors and a

waggon loader would make it easier still.

My short series comes to an end in the next issue. I have been duped into promising a note on the economics of trays—I, who drive only a Ford Van! Not a Jaguar in sight.....



SEEN THIS? - I

The first of a new series of notes on equipment which may have escaped the notice of the commercial mushroom grower.

Manufacturers or suppliers are invited to contribute.

Messrs. Pinkerton's Scottish Mushroom Laboratories, Millerston, Glasgow, write: "Growers are continually sending samples of compost to be tested but they seem to overlook the fact that by the time we get an answer back to them the pH has altered. This was one of the moving factors in bringing out this **Compost Testing Kit**. It is simple

to work and easily handled and the complete operation takes but a few minutes. With practice it soon becomes possible to determine to 0.1 the pH reading of any compost. No scientific skill is required—only a steady hand and normal eyesight. Priced at £3 10s. 0d., no grower should be without one."

Malt Culms as an Activator

A Norwegian Experiment described by Per Hjort Master Brewer and M.G.A. Overseas Member

Although at Norsk Champignon we produced about 30,000 lb. of mushrooms in 1950, the yields in our permanent rooms were far from satisfactory. Among other causes, much damage was done by springtails; the infestation was so heavy that dusting with BHC and nicotine proved almost futile, and we averaged only 0.7 lb. per sq. ft.

I had been advocating peak heating for some time, but we had to await the arrival of Mr. Atkins' "Mushroom Growing To-day" for new inspiration and the requisite practical advice. We peak heated a room of 2,400 sq. ft. at the beginning of November. It came into bearing in eight weeks, and cropped for eight weeks, producing 1.6 lb. per sq. ft. (Our best previous yield had been 1.4 lb. in 12 weeks picking).

A compost experiment was carried out in the next room to be peak heated, and as the result is rather astonishing I thought members might like to hear about it.

The compost was made from our usual strawy racing-stable manure. The day before the fourth and last turn, 4.7 cubic yards of a mixture of brewers' grains and malt culms was placed on top of the stack and next day thoroughly mixed into the compost. Two days later was filled to a depth of 8" and peak heated.

The beds were spawned and cased in usual way, and we had an outbreak of stroma, which was remedied by adding a little extra casing soil. Cropping started on 29th January. After 32 days we had picked 1.85 lb. per sq. ft., and it looks like doing 2 lb. in 42 days, although growth appears to be slowing down.

The idea of using malt culms as a growing medium occurred to me many years ago, before I started growing mushrooms in an amateur way. It so intrigued me that I induced a well-known mycologist, M. Kr. Horn, to experiment with them at Oslo University's Institute of Botany. There was no yield—which is quite natural, as I know little about composting and thought synthetic compost a very original idea of my own!

It was at a Brewers' Meeting in Oslo last autumn that my old idea was revived by the information given that brewers' grains were now and then supplemented by varying amounts of malt culms. I at once arranged for delivery of a couple of truck-loads. I had already tried brewers' grains alone, without malt culms, and had little success; admittedly that was before the introduction of peak heating. In my last experiment the culm/grains mixture was probably about 30% culms by volume. Of course the problem needs more thorough and scientific investigation. Perhaps the idea may be of use to the M.R.A. The composition of malt culms, according to Hopkins and Krause's "Biochemistry Applied to Malting and Brewing" is: "Moisture

5.35%, protein 30.70, fat 1.53, mineral matter 6.23, cellulose 7.08, N-free extract substance 49.11. Their nutritive value is considerable corresponding to about 80% of that of barley weight by weight."

The rapidity of cropping, I think, may be due to some growth-promoting substances. The culms contain Vitamins B and E. Besides, I do not think all of the original enzymes are destroyed in the kiln process.

WHO'S WHO in the Mushroom World

I—Professor H. PALUDAN



Hother Paludan was born in 1888 at the Danish Royal Palace, Rosenborg, where his father was Superintendent of the Royal Park. Rosenborg in the Nineteenth Century was Denmark's most famous centre for the study of horticulture; its teaching is to-day continued in the Horticultural Department of the Agricultural High School, in Copenhagen.

In 1911 Paludan graduated as the best scholar of his year. He travelled extensively, visiting Germany, Holland, Belgium,

France, Great Britain and the United States. He worked as head gardener at Bernstorff, S'olyst and Vilvorde, and in 1941 joined the staff of Copenhagen High School as Professor of Economic Botany.

More than most professors, he is a **practical** man. His special interests are mushrooms, roses and carnations. Always gay and smiling, his popularity is so great that, to mark his 60th birthday, the gardeners in Denmark presented him with a car.

Until 1929, mushroom growing in Denmark was of little importance. Following his visit to the U.S.A., Paludan introduced pure-culture spawn and American-type houses. At once the mushroom industry in his country rapidly expanded and its efficiency made great strides.

Inspired by the work of the Yaxley Research Station, particularly during his attendance at the International Conference on Mushroom Science in England in 1950, Paludan returned to Denmark determined to build a mushroom research station in Copenhagen. He is a fighter who usually gets what he wants. Good luck to him! P.J.B.

Correspondence

We are just about to leave this country for good in the hopes of finding some land more free of **frustration** and ever-increasing financial worries. Doubtless we shall have to be nomads for some time to come—but perhaps there is such a land somewhere. I should like to take this opportunity of thanking you for all the help and advice, especially through your interesting Journals, you have given us since we started in 1946, and to wish you the best of luck.

Col. R. P. HENSTOCK.

The people here (**New South Wales**) thought that a reduced production all round, combined with shorter hours and greatly increased wage packets thrown in, would mean an abundance of everything. This country is rich, yet it is short of every single essential. Public properties are rotten, electric generating stations in the last stages of decay, short hours, go-slow strikes, graft, shipping lines selling out, Governments afraid of Unions, and Unions dominated by Communists Ever since landing, responsible people have said: "A bust-up must come; let it come soon." This is a beautiful country with a beautiful climate. Only man is vile!

I. W. READ.

Many thanks for your beautifully got up and written Bulletin.

JOHN FOTHERGILL.

Congratulations on a most effective job of re-styling your Bulletin. It is a very lively and attractive presentation.

HARRY NEWMAN (Newman Neame Ltd., publishers of "Mushrooms Galore").

The **grading** recommendations regarding stem lengths are unnecessary. I suggest we cut back the stem so that it is equal in length to the thickness of the cap. This meets all qualities—buttons, closed cups, open cups, flats and even chats.

J. HUNTER-CARR.

You ask what is meant by "anhepsetal" cooking. "Anhepsetal" means cooking at a controlled critical sub-boiling temperature, a process which tenderises, reduces shrink, and automatically makes over-cooking impossible. It has been applied so far to meat, fish, eggs and potatoes with highly interesting results. I have not yet tried it with mushrooms!

PHILIP HARBEN.

I was asked if I would contribute some mushrooms to help the stand representing Agricultural Production in Cumberland, at the Carlisle Industrial Show. To-day H.R.H. Princess Margaret visited the Exhibition and we had two little grape boxes, suitably decorated and with mushrooms growing on them. Although I was busy turning and casing and other "chores" I believe (and indeed heard from the Secretary) that they were the main attraction on the stand! Although it was strictly un-named, it must have done Mushrooms a lot of good and further reinforced the existing friendship between the N.F.U. and ourselves which I consider so important.

Capt. GILES TWEEDIE.

PRESS CUTTINGS

The Horticultural branch of King's Lynn N.F.U. has unanimously passed a resolution that it is in favour of one comprehensive **marketing scheme** for horticultural produce rather than a number of schemes in respect of individual crops. *Fruit Trades Journal*, 24.3.51.

The general outcome (of the Torquay Conference) has been to leave the British Government free to consider the industry's case for **revision of tariffs** over a wide range of horticultural products (including the case for Mushrooms—Editor).

Nurseryman & Seedsman, 17.5.51.

It is now clear that **folic acid** will take its place among the vitamins. . . . The name was originally given to an almost pure chemical substance isolated from spinach; it is found in many other green leaves, including grass, and in mushrooms, liver and yeast.

The Lancet, 9.11.46.

R. G. Darlington (W. Darlington & Sons Ltd.) gave it as his firm opinion that the average mushroom grower to-day is very much better informed and more efficient than before the war. "Growing mushrooms," he warned, "is not an easy-money venture for the dabbler. It is a **specialist's job**, and requires both training and capital."

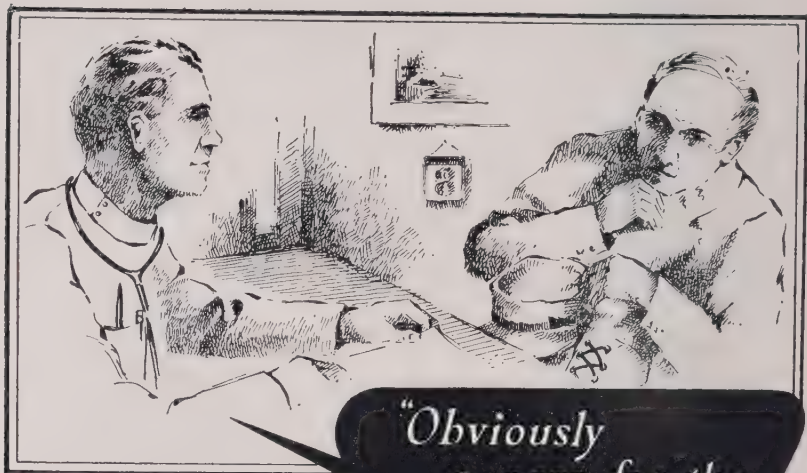
Nurseryman & Seedsman, 19.4.51.

The Ministry (of Agriculture) is prepared to lend printers' blocks to those growers and packers who undertake to pack according to the **recommended grades** and who wish to incorporate the Identification Mark in their own consignment labels or in the printing of container covers in which space is provided for the insertion by the packer of the grade names appropriate to the packed produce. (Application should be made to the Secretary, Ministry of Agriculture, Marketing Division, 36/38 Chester Terrace, London, N.W.1.)

Fruit Trades' Journal, 30.6.51.

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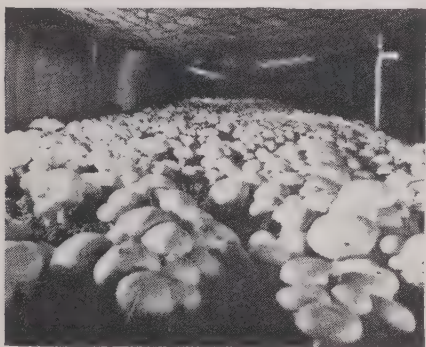
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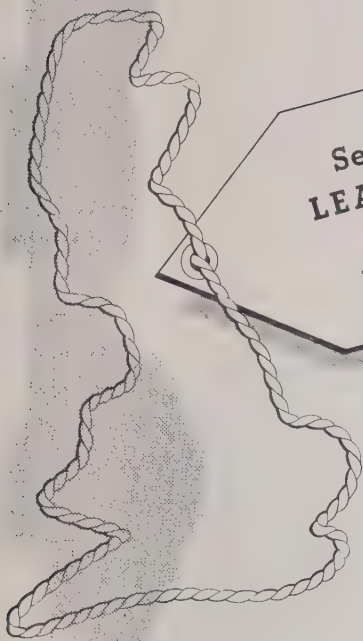
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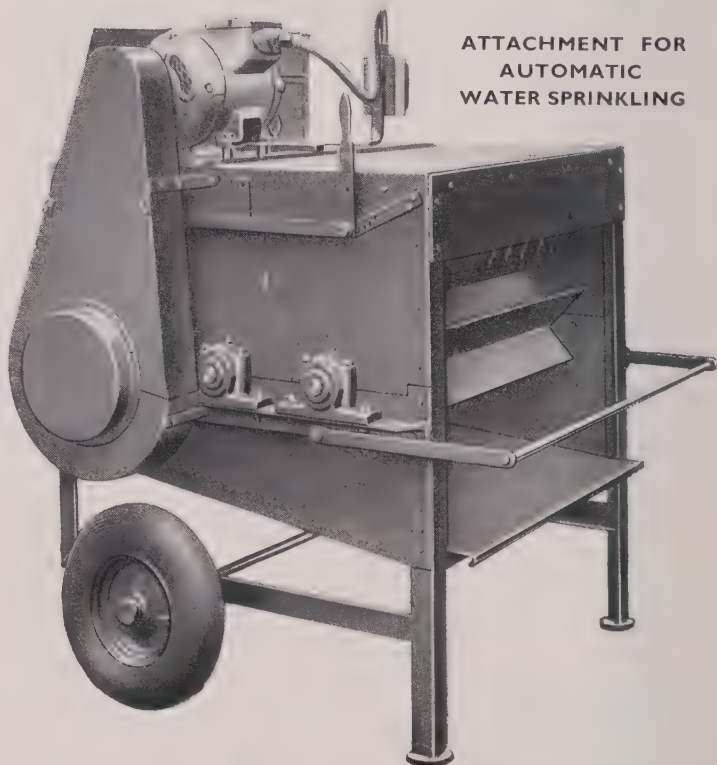
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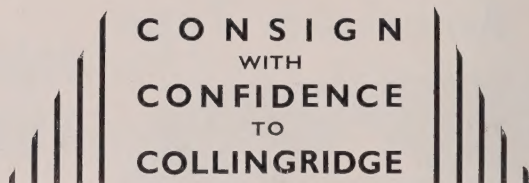


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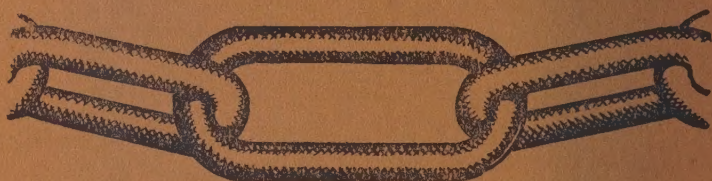
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